AMENDMENTS TO THE SPECIFICATION

On page 1, please amend the title as follows:

~~Improvements in or relating to machine vision equipment~~

IMPROVEMENTS IN OR RELATING TO MACHINE VISION EQUIPMENT

On page 1, following the title, please insert the following:

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a National Stage of International Application PCT/GB2004/001177, filed March 19, 2004. Applicant claims foreign priority benefits under 35 U.S.C. 119(a) – (d) of the following foreign application for patent: United Kingdom Application No. 0306467.2, filed March 20, 2003, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

On page 1, beginning at line 5, please amend the paragraph as follows:

Co-pending international patent application no. PCT/GB2004/~~xxxxxx[attorney reference JRJC/41823]~~ 001181 , corresponding to earlier United Kingdom application no. 0306468.0, the contents of which international application are fully incorporated herein by reference, discloses a method and apparatus for determining one or more physical properties of a rolled smoking article or filter rod, comprising positioning a rolled smoking article or filter rod within a field of view, illuminating the field of view, imaging the rolled smoking article or filter rod within the field of view to form an image, and analyzing the image to determine one or more physical properties of the rolled smoking article or filter rod. Typically, the image is a digital image which is acquired using a digital camera, preferably a digital video camera. The image may be acquired using any wavelength or range of wavelengths, for example infrared light. Thus, the

image comprises a digital array of pixels which may be analysed using suitable processing means to determine one or physical properties of the rolled smoking article or filter rod such as its length, diameter, ovality, and the like.

On page 1, at line 19, please amend the paragraph as follows:

As described in co-pending PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181, analysis of the digital image may be performed using well-known algorithms to detect edges within the image.

On page 2, at line 9, please amend the paragraph as follows:

Calibration of machine vision equipment is typically carried out using reference objects of accurately known dimensions. A known reference object comprises a machined solid steel cylinder having an accurately known diameter. Steel reference objects are used in view of the good dimensional stability. However, metal reference objects are not suitable for calibrating machine vision equipment of the kind described by co-pending PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181 in view of the high reflectance of the metal.

On page 2, at line 19, please amend the paragraph as follows:

There is therefore a need for a dimensionally stable reference object which is suitable for use for calibrating machine vision equipment of the kind disclosed by co-pending PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181 .

On page 5, at line 1, please amend the paragraph as follows:

Thus, as disclosed in co-pending PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181, the camera may comprise means for automatically adjusting the focal length of the camera. For example, the camera may comprise a barrel portion housing a lens, and said barrel portion may be provided with a gear which is adapted to be driven

by a toothed belt from a DC motor controlled by said controlling means. As described above, it is important, when measuring dimensions of a test object by analysing a digital image of the test object to detect the presence of significant edges, to ensure that the image of the test object is properly in focus. Thus, in accordance with the present invention, the optimum configuration determining means may comprise optimum focal length determining means, and said controlling means may be adapted for controlling the adjusting means, imaging means and optimum focal length determining means to obtain and process serial images of the reference object at different respective focal lengths, and to determine the optimum focal length at which the reference object is best in focus, and for controlling the adjusting means thereafter to adjust the focal length of the camera to said optimum focal length.

On page 7, at line 18, please amend the paragraph as follows:

The present invention therefore provides improvements in or relating to machine vision equipment, particularly equipment of the kind described by co-pending PCT/GB2004/xxxxxx[*attorney reference JRJC /41823*] 001181 by providing a method and apparatus for automatically setting-up the machine vision equipment; in particular to set-up automatically the focal length and calibration of the machine vision equipment. The present invention also provides a suitable ceramic reference object for use in the automatic setting-up method of the present invention.

On page 7, at line 25, please insert a page break, insert the following heading and paragraph:

BRIEF SUMMARY OF THE INVENTION

Machine vision equipment for determining at least one physical property of a smoking article, according to a typical embodiment, includes a camera defining a field of view and being adapted to form an image of the article within the field of view, and a processing unit which processes the image to determine at least one physical property of the article, a first support which supports the article within the field of view at a

predetermined distance from the camera, a second support which supports a reference object having at least one accurately known dimension, a moving mechanism which selectively moves at least one of the camera, the first support, and the second support such that a reference object placed on the second support is disposed within the camera's field of view at the predetermined distance from the camera, an adjusting unit which automatically adjusts the configuration of the camera, a processor which determines the optimum configuration of the camera by processing at least one image of a reference object placed on the second support, and a controller which controls operation of the moving mechanism, camera, adjusting unit, and processor in order to bring a reference object supported by the second support into the camera's field of view, to image the reference object, to determine the optimum configuration of the camera, and to adjust the camera to the optimum configuration.

On page 7, at line 27, please amend as follows:

In the drawings:

BRIEF DESCRIPTION OF THE SEVERAL VIEWS
OF THE DRAWINGS

On page 8, at line 1, please insert the following heading and paragraph:

DETAILED DESCRIPTION OF THE INVENTION

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

On page 8, at line 1, please amend the paragraph as follows:

Co-pending international patent application no. PCT/GB2004/~~xxxxxx[attorney~~ ~~reference JRJC /41823]~~ 001181 discloses machine vision equipment for measuring one or more physical properties of a rolled smoking article or filter rod such, for example, as a cigarette **10**. As described above, the present invention relates to improvement in or relating to such machine vision equipment, and accordingly, full details of the construction and operation of the machine vision equipment are not repeated herein; the following describes the machine vision equipment only to the extent that is necessary to describe the improvements provided by the present invention.

On page 8, at line 9, please amend the paragraph as follows:

Thus, as described in PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181, machine vision equipment comprises a vision system **200** comprising a digital near infrared video camera **222** and having a barrel portion **224** accommodating a lens (not shown) which defines a first optical axis **230**. The vision system **200** is connected to a suitable computer control system (not shown) which includes a frame-grabber device adapted to receive and capture and video signal from the camera **222**. The barrel portion **224** is formed with a gear (not shown) which is drivable by a DC motor for automatically adjusting the focal length of the camera **222**.

On page 9, at line 29, and continuing over onto page 10, please amend the paragraph as follows:

The rollers **310, 311; 312** are configured to support slidingly a rolled smoking article or filter rod, such as cigarette **10** as shown in FIGS. 1 and 2. The transport system comprises a pusher (not shown) for pushing the cigarette **10** axially along the V-shaped grooves **314** defined by the respective pairs of rollers **310, 311; 312**, and the rollers and jig member **240** are positioned so that the cigarette can be transferred smoothly from one pair of rollers **310, 311** to the other pair **312** *via* the jig member **240**. The rollers **310-312**

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are connected to the computer control system and are adapted to rotate about their respective axes as shown in FIG. 1 so as to rotate the cigarette **10** about its longitudinal axis **16** for reasons described in co-pending PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181 .

On page 13, at line 30, please amend the paragraph as follows:

The calibration curve generated by the computer control system is stored in the ~~computers~~ computer's memory, and the belt drive **412** is then returned to its start position such that the jig member **240** is disposed in the space interposing the opposing ends of the pairs of rollers **310, 311; 312** as described above. The machine vision equipment in accordance with the present invention is then set-up to measure one or more physical properties, particularly the dimensions, including diameters, of test objects in the object space **250** carried by the rollers **310, 311; 312** in accordance with co-pending PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181.

On page 14, at line 8, please amend the paragraph as follows:

The present invention thus provides improvements in or relating to machine vision equipment of the kind described in co-pending PCT/GB2004/~~xxxxxx[attorney reference JRJC /41823]~~ 001181 by providing automated setting-up of the cameras **222** focus and calibration of the vision system using a plurality of reference objects in the form of accurately fabricated ceramic cylindrical bars.

On page 14, at line 13, please add the following paragraph:

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

On page 14, at line 14, please insert a page break and add the following heading and paragraph:

ABSTRACT OF THE DISCLOSURE

A method of setting-up machine vision equipment is disclosed. The equipment includes a camera defining a field of view, processing means for determining physical properties of a test object, and first supporting means for supporting a test object at a predetermined distance from the camera within the field of view. The method is characterised by providing second supporting means for supporting a reference object, placing a reference object having at least one known dimension on the second supporting means, moving one or more of the cameras, the first supporting means and the second supporting means to bring the reference object within the field of view at the predetermined distance from the camera, imaging the reference object to obtain an image, and processing the image to determine the optimum configuration of the imaging means, and adjusting the imaging means configuration to the optimum configuration.